## REMARKS

I. Status of the Claims

In the Final Office Action, the Examiner indicated that claims 1-23 are pending, 11-19 are rejected and 1-10 and 20-23 are withdrawn from consideration. New Claim 24 has been added.

II. Rejection of Claims 11, 12, and 18 under 35 U.S.C. §103(a),

In paragraph 4 of the Final Office Action, the Examiner states: "Claims 11, 12, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,415,388 (Browning) in view of U.S. Patent 6,928,559 (Beard) and Nguyen (U.S. Patent Application Publication 2004/0003301).

In paragraph 5, the Examiner alleges that "In re Claim 11, Browning et al teaches the following method of improving timing margin of at least one path on a semiconductor chip...". Applicants respectfully disagree.

At a high level, as well-described in Applicants' specification, Claim 11 is directed to improving timing margin of at least one path on a semiconductor chip by managing a voltage supply to be as high as possible while operating at a predetermined frequency. This is accomplished by periodically raising a voltage supply to increasingly higher voltages until either a high voltage limit is reached or until a temperature reaches a temperature limit.

The Examiner, in the Office Action dated 06/13/2007 and prior Office Actions, has produced several references that teach of making use of the well-known power/performance characteristics of CMOS logic to adjust frequency and voltage in lock step, that is, whenever voltage is changed, frequency is always also changed. The Examiner had cited these references in previous Office Actions. Applicants responsively amended original Claim 11 to add the limitation of not changing a frequency, which Applicants submit overcome Browning and Beard separately or in combination. Applicants have explained in responses to earlier Office Actions that neither Browning nor Beard have any teaching, suggestion, or motivation whatsoever with regards to improving a timing margin. In stark contrast, by moving voltage and frequency together upwards along the power/performance characteristics of CMOS logic, timing margins in Browning and Beard remain constant, and in fact, are reduced, since small timing anomalies, as

explained in Applicants' specification, do not scale with voltage. For example see paragraph [0033] in Applicants' specification.

The Examiner, in the present Office Action adds a citation of Nguyen (2004/0003301), stating, in paragraph 11 of the Office Action, "*Nguyen teaches that it is known to adjust only voltage or voltage and frequency in response to temperature conditions (Paragraph 9). It would have been obvious to one having ordinary skill in the art at the time the invention was made to adjust only voltage as opposed to adjusting both voltage and frequency since Nguyen teaches that they are known alternatives when controlling performance of a processor based on temperature measurements.*"

Nguyen's paragraph 9 states: "*The prior art has attempted to address the heat dissipation problem presented by portable computers. In one prior art example, the processor monitors its own temperature via a temperature sensor (e.g., a temperature sensitive diode). If a temperature reaches a threshold, the processor will throttle itself (e.g., reduce its operating voltage and/or frequency) to reduce the amount of heat being generated.*"

In Nguyen, paragraph 9, if both operating voltage and frequency are reduced, Nguyen's reference teaches the same function as Browning and Beard, (i.e., following a power/performance characteristic) which, for the reasons given above and in earlier responses, Applicants submit, do not justify a rejection under 35 USC 103(a), since they do not teach of improving a timing margin.

Applicants respectfully point out that Nguyen's paragraph 9 **reduces** timing margin if only operating voltage is reduced and frequency is not reduced. Nguyen, paragraph 9, is similar to Applicants' Claim 11 limitation, "if a thermal fault is detected, lowering the voltage supply to a second voltage value lower than the first voltage value". Nguyen, alone or in combination with other references cited, does not teach, suggest, or motivate one of ordinary skill in the art to improve timing margin – a further element in Claim 11. Applicants submit that the method claimed – dynamically operating at as high a voltage as possible, subject to thermal considerations to improve timing margin – was not obvious at the time of the invention, or such practice would be widespread. However, there is a complete absence of such teaching in the art, as revealed by the references cited.

Applicants therefore respectfully ask that the Examiner reconsider his rejection of Claim 11 under 35 USC 103(a) and withdraw the rejection.

In paragraph 12, page 4, of the Office Action, the Examiner continues with regards to Claim 12, that Browning would eventually lower the operating voltage a second time. Applicants believe that Claim 11 is allowable, and therefore, Claim 12, which depends from Claim 11, is also allowable. Regarding the teachings of Browning with reference to Browning's Fig. 6, it is again pointed out that, as in all of the Examiner's other references, frequency is always changed lockstep with voltage, both in figure and in specification. Nguyen, as noted above, teaches lowering voltage without changing frequency, but does so at the expense of reducing timing margin. The Examiner also references Beard in paragraph 12 of the Office Action. Also as pointed out above, Beard teaches of changing frequency and supply voltage in lockstep, and does not by itself or in combination with Browning teaches of improving timing margin.

In paragraph 14, on page 5 of the Office Action, the Examiner states: "Claims 13-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Browning et al (U.S. Patent 6,415,388) in view of Beard (U.S. patent 6,928,559) and Nguyen as applied to claim 11 above, and further in view of Temperature Sensor and System Monitor in a 10-pin microMAX by MAXIM. Applicants believe, as explained above, that Claim 11 is allowable and therefore Claim 13 (and dependents 14-17) is allowable. To further distinguish Claim 13 over the references, Applicants amend Claim 13 to include a limitation wherein the low limit voltage is determined from a performance-measured data (see [0048]). MAXIM teaches nothing about use of a performance measurement on a chip (e.g., ring oscillator) to determine how low a supply voltage can be for operation at a particular frequency. Since claim element "low limit voltage" has been added to Claim 13, Claim 14 has been cancelled.

In paragraph 19 of the Office Action, the Examiner rejects Claim 14 and 16 over MAXIM. Applicant above distinguished "low limit value" over MAXIM in the amendment to Claim 13. Applicant believes that Claim 11 is allowable and therefore Claim 16 is allowable.

In paragraph 20, the Examiner rejects Claim 15, citing MAXIM. Applicants believe that Claim 15 (amended to depend from Claim 13 instead of cancelled Claim 14) is allowable by virtue of dependency from Claims 13 and 11 which Applicants submit are allowable.

In paragraph 21, the Examiner rejects Claim 17, referencing Browning, Beard, and MAXIM. Applicants believe that Claim 17 is allowable because of the believed allowability of claims 16, 13, and 11 from which Claim 17 depends.

In paragraph 22, the Examiner rejects Claim 18 under Browning, Beard, and Nguyen, as applied to claim 11 and in further view of Hobson (U.S. Patent 6,112, 164). Applicants believe that Claim 18 is allowable by virtue of dependency.

However, Applicants amend Claim 18 to more clearly distinguish over Browning, Beard, Nguyen, and Hobson by clarifying that changing the interval is done responsive to a rate of temperature change measured on the semiconductor chip and how close the current temperature is to the high limit temperature. See [0056], [0057], [0058]. The Examiner alleges without example or support that changing the time interval from a first predetermined time interval to a second predetermined time interval in order to manage the different hysteresis characteristics that may exist in different thermal situations with time delay would be obvious to one having ordinary skill in the art. "Hysteresis" is believed by Applicants to pertain to "lag" rather than "memory". Beard does not teach or suggest other than one time period. A high rate of change of temperature may be caused, for example, by initiation of a numerically intensive computer program on the semiconductor chip. A high rate of change may, in Applicants' teachings, may not cause a change from the first predetermined interval if the current temperature is different enough from the high limit temperature. If, however, the temperature change is rapid and the voltage is near the high limit voltage, a shorter interval is advantageously used. The references cited to not teach, suggest, or motivate such an interval change. No teaching, motivation or suggestion in the field has been cited. Applicants submit that the amendment to Claim 18 clearly distinguish Claim 18 over Browning, Bear, Nguyen and Hobson and respectfully ask that the Examiner withdraw his rejection.

The Examiner further argues that changing an interval would have been obvious, "since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art." citing *in re Boesch* 617 F. 2d 272,205 USPQ 215 (CCPA 1980). In re Boesch held that "*Discovery of optimum value of result effective variable in known process is ordinarily within skill of art*". The holding further states: "*We note again that the prior art teaches that reduction of the Nv value reduces the chances of sigma phase in the alloy. Here*

*appellants tested only one example of a low Nv value alloy and found no sigma – a result consistent with both the prior art teaching and appellants' allegation that their claimed alloys are 'totally free from sigma phase.' Under such circumstances, test results involving a single alloy within the broad range claimed are not sufficient to support appellants' allegation of what would, from the prior art, be unexpected.*" Applicants respectfully submit that Claim 18, especially as amended, clearly distinguishes from simply finding a "best" value within a known range of values, which is the holding of *In re Boesch*. Use of a voltage derivative and difference from a limit to change an interval differs dramatically from simply finding a best value within a known range of values.

Applicants note that Claim 19 is rejected on paragraph 5 of PTOL-326, but Applicants did not find further discussion of the rejection in the Office Action. Applicants believe that, since Claim 19 states: "A program product comprising computer readable instructions, distributed on a computer readable media, that, when executed on a suitable computer, performs the steps of claim 11." that the Examiner rejects Claim 19 for the same reasons he rejects Claim 11. The Examiner is asked to reconsider and withdraw his rejection of Claim 19 for the same reasons given earlier with regard to Claim 11.

In view of the prosecution to date, Applicants add new independent Claim 24, which Applicants submit clearly distinguishes over the art cited by the Examiner. That is, the Examiner has cited various schemes that follow power/performance curves and which therefore do not improve timing margin, or (Nguyen, as discussed earlier) a scheme that simply lowers supply voltage and suffers an attendant decrease in timing margin.

IV. Conclusion

In view of the foregoing comments and amendments, Applicants respectfully request that the application, with claims 11-13, and 15-19, and 24, be passed to issue. Applicants' agent invites the Examiner to call at the number below if the Examiner would feel that a phone call would expedite prosecution of this case.

Respectfully submitted,

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